RETIREMENT INCOME MODELLING TASK FORCE

An Ageing Society:

A Working Life / Retirement

Perspective.

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An Ageing Society:
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Over the last decade there have been major changes in the working patterns for both males and females in Australia, including:

- a general decrease in the participation rate for men,
- a general increase in the participation rate for females,
- the move from full-time to part-time employment
- an ageing of women having their first child,
- longer periods spent in education by the young, and
- early retirement.

These changes in working patterns are occurring in conjunction with increases in life expectancy and as the baby boomers move through to retirement, we will see a marked ageing of the population over the next half century. In general, the length of working life is decreasing and the length of life in retirement is increasing.

The Retirement Income Modelling (RIM) Task Force was established to address the issues raised by the ageing of the population from the perspective of the future superannuation/pension needs of Australians and its implications for public policy. This paper draws on the RIM parameter research to provide some insight into the dynamics of the ageing society through a study of work and retirement.

THE RIM TASK FORCE

The RIM Task Force is charged with developing public policy models and analytical tools to investigate the interaction of demography, social security, taxation and superannuation. Its principal object is to "To develop a capacity for modelling the impact of retirement income policies over the next half century and provide advice to departments and Ministers as required on policy options affecting retirement incomes." The Terms of Reference of the RIM Task Force (see Gallagher 1995) require it to build hypothetical (individual and couple) as well as aggregate (whole population) projection models, which must be sufficiently disaggregated to provide insight into a wide range of public policy questions, including:

- *"- the quantum and distribution of retirement benefits*
- *the age pension system and the social security system generally*
- *the quantum and distribution of superannuation tax concessions*
- *the fiscal balance*
- *superannuation assets*
- *private sector saving*
- *national saving*
- *workforce participation and retirement patterns*

as well as

- *demographic variables*
- *retirement benefits commutation patterns*
- *lump sum dissipation patterns*
- *fund earnings rates*

- *key macroeconomic and microeconomic variables*
- *the retirement age decision*
- *contribution/earnings patterns over the life cycle*
- *relevant tax, superannuation and social security parameters."*

To support model development and to provide some insight into the many policy issues to be investigated, a parameter research program was established to investigate the fundamental socio/economic structural shifts occurring in "Australia's Population into the Next Millennium". The principal aim of the parameter research program is to provide the disaggregated demographic parameter sets which are critical for successful modelling of aggregate superannuation and which form the basic parameter inputs to the RIM superannuation models.

The demographic variables of interest to RIM include sex, age and income deciles structure of: population levels, fertility, deaths, migration, labour force status by full/part-time and public/private, disability, retirement, pensioners and career earnings. In satisfying this aim, the parameter research program has developed stand alone long-run projection models of population, retirement, labour force status, lifetime earning profiles and asset accumulation (in progress) which complement derived distributions of superannuation contributions and assets.

The projection models of the RIM Task Force do not claim to predict or forecast the future. Rather they allow a user to explore the effects of alternative policy across a variety of user specified scenarios about the future. Nevertheless, the models can show that some scenarios about the future are more consistent with the existing situation and recent trends than other scenarios.

SUPERANNUATION MODELS DEVELOPED BY RIM

The Task Force has chosen to develop three types of superannuation micro models to address its terms of reference. A list of RIM's superannuation models is given in Attachment A.

Hypothetical tax-benefit models cover one individual, a couple (or income unit). The RIM Task Force's **INDMOD and RIMHYPO** models take an individual or couple from work force entry to death. All relevant combinations of life events, government policies and retirement income sources can be modelled. These models capture in detail the legislative structure defining the interactions between superannuation, taxation and social security legislation. The complexity of this structure is illustrated by the fact that RIMHYPO contain some 16 thousand lines of code.

Cohort models track the lifecycle of groups in the population. They are also referred to as group projection models, actuarial models or cell based models. Cohort models concentrate on population changes and accumulation processes over time, and on incrementing or decrementing processes within a time period.

Because the whole population is covered, cohort models can be used for costings to the extent that the group structure is sensitive to the parameters of the costing. When group models are used for projections, insufficient or inappropriate group disaggregation can lead to inappropriate **pooling** of accumulations. For example, a coarse income distribution can lead to a poor costing of a new income test but give a reasonable approximation to aggregate superannuation contributions and earnings. Because of these effects, most costing spreadsheets can only be regarded as short period group models.

RIMGROUP is the main policy model of the RIM Task Force. It is a comprehensive cohort projection model of the Australian population which starts with population and labour force models, tracks the accumulation of superannuation in a range of account types, accumulates non superannuation savings, and calculates tax payments and expenditures, social security payments including pensions and the generation of other retirement incomes. Again the full richness of the underlying legislation is captured.

RIMGROUP projections are done for each year of the projection period separately for each birthyear, gender, and career earnings decile cohort. The model projections begin in July 1992 and can run out to June 2060. There are over 4300 cohorts in the model covering the Australian population, which includes relevant demographic detail for each cohort. Each cohort is tracked through its lifecycle (between age 18 and 100+ depending on birth year) with superannuation and asset modeling through all of working life and retirement.

Static microsimulation models, in contrast, concentrate on the distributional detail of single year flows and statuses and can only be used for short-run projections. For example, each year in RIM's microsimulation model based on personal income taxation data is represented by 63,000 records and the model is only used for projections to 2004/05. RIMGROUP provides demographic profiles by which the static microsimulation model base populations are reweighted for later years. Treasury economic forecasts provide indices for uprating incomes.

PARAMETER RESEARCH

It is clear that superannuation accumulation and superannuation adequacy are critically determined by a person's life expectancy, their labour force experience and retirement behaviour

Development of micro models of the interaction between superannuation, labour markets, social security and taxation over a 60 year time horizon, at both an aggregate and individual-based level, required research and development of **plausible, consistent and defensible** long-run scenarios and parameters as input to the RIM models. Our approach has necessarily been pragmatic.

Clearly the research must attempt to capture possible behavioural shifts over the next half century. If this is not difficult enough, it must done by gender, age and earnings decile. We have not attempted to develop models to **explain** the socio/economic shifts we have observed in recent times. Many of these behaviour shifts are poorly understood by the profession. For example, the shift to part-time work and other working life decisions is not well understood. Further, theory usually, provides little guidance on the functional form of relationships. In particular we have steered away from econometric techniques and have adopted a non-parametric approach which looks for, and estimates, stable long-run relationships in the historic data and which develops methodologies to project them in a consistent framework.

There are a number of reasons for this approach. Firstly many of the relations we are interested in are highly non-linear with complex functional forms. Econometrics is largely based on tightly specified parametric models. When the functional form is misspecified, estimates may not only be efficient but may not even be consistent. Thus the costs of imposing strong parametric restrictions can be considerable. Further, econometric analysis is often specified as a linear function. This may be sufficient for short run time series analysis but does not provide an adequate framework for the analysis of long-run behaviour at a highly disaggregated level. In general we have employed nonparametric smoothing methods which do not impose parametric restrictions on the functional form.

Much of the data available for analysis comes as grouped data (ie age groups). Group data can hide many interesting movements in the data and it is for this reason we have used single year age specific data where ever available (and affordable). Examples of the loss of information from grouped data are given below. Further, we have found that single year age specific data can reveal problems with the data which are not evident at the more aggregate level.

The down side from single year age-specific data is the degree of sample noise that is introduced into the data. Given that much of the data we are interested in is slowly moving by age (except for discontinuities) and in time, we have implemented multivariate cubic spline smoothing and cubic spline interpolation. Smoothing techniques now exist which allow for local control of the degree of smoothing to estimate visually pleasing and shape preserving profiles of the underlying data. Cubic spline smoothers can capture particular features of the data we may wish to preserve: monotonicity, convexity, discontinuities, simultaneity, end point (edge) conditions, open ended data points and aggregate consistency to name some issues we have addressed. Further discussion of this topic would require a separate paper.

DEMOGRAPHIC MODELS

As noted above, a principle objective of the parameter research program is to provide the disaggregated demographic parameter sets which are critical for successful modelling of aggregate superannuation. The demographic variables of interest include population totals, sex and age structure, fertility, deaths, migration, labour force status by full/part-time and public/private, disability, retirement, pensions and career earning profiles by deciles. These projections are produced by a set of annual demographic models for Australia to the year 2059. The models include a population model (POPMOD), a life expectancy model (LIFE), a retirement model (RETMOD), a labour force status model (LFSMOD), a set of career earning procedures (CEPROC). and a financial assets model (ASSMOD) which is still under construction.

POPMOD - Population Model

POPMOD provides annual projections of Australia's population by year for males and females by single year of age up to 100 plus years. The model is driven by parameter matrices for fertility, mortality and overseas migration. The overseas migration sub-model accepts projection of permanent and long-term arrivals and departures and measures of category jumping. The age and sex distribution are separately modelled POPMOD has been calibrated to reproduce the series A population projections from the ABS (ABS CatNo 3222.0) which are used as the base population projection for RIM analysis. POPMOD has, however, been designed with a user friendly interface which allows easy age-specific changes to fertility, mortality and migration assumptions for sensitivity analysis. Further information on POPMOD can be found in Bacon 1994, and Rothman and Bacon 1994.

LIFE - Life expectancy Model

The life expectancy model calculates survival rates, survivors to age x, deaths at age x to x+n, life table populations and life expectancy for males and females by single year of age up to 100 plus years. The estimates are constructed from the mortality parameters used in POPMOD. These life expectancies are used in both the demographic and policy models of the RIM Task Force. In the policy models they provide factors for annuity and allocated pension pricing.

RETMOD - Retirement Model
This model provides annual projections of retirement by gender, age and income decile. More details of this model are given below. A fully version of this material can be found in Bacon (1996a).

LFSMOD - Labour Force Status Model
This is long-run annual model of the Australian labour force to capture structural (trend) behaviour at fine detail. The model projects persons by labour force status, age, gender and income decile. (Marital status of females is possible but not currently in use.) Labour force status is split by employed/unemployed, full-time/part-time, public/private, wage and salary earners/employers/self employed. Persons not in the labour force are split by retired/never in labour force/permanently disabled/temporarily not in the labour force . There is no short-run behavioural response in LFSMOD, the model simply runs off the observed underlying long-run movements of key, and hopefully stable, parameters, which are estimated as non-linear trends with consistent asymptotic values. Apart from these time-varying parameter matrices, the model's only exogenous inputs are population projections from a population model, such as POPMOD, and aggregate unemployment rates for males and females. (See Attachment B for an overview of the models structure).

CEPROC - Career Earning Procedures
This is a set of complex procedures used to estimate career earning profiles by labour force status, age, gender and income decile. The procedures allocate the population by labour force status to each career earning decile. These allocations are used to construct the income decile proportion parameters used in LFSMOD.

AGEING AND WORKING LIFE

Participation Rate Developments:

The total participation rates in Australia have been rising over the last the last two decades. These movements are driven by a long run increase in female participation which has been offset, to a lesser extent, by a falling male participation rate. Since the ratio of males to females remains constant, these trends do not arise from compositional shifts, but have their origins in a number of fundamental supply and demand pressures in the economy. Although there are significant cyclical (short run) movements in the participation rates, the long run trend must be explained in both economic and social shifts.

On the labour demand side there have been:
- attitudinal shifts by employers with regard to employing women,
- growth of industries which favour female employment and
- increased use of part-time (and casual) employment
  (which fits the lifestyle requirements of many women).

On the supply side:
- the relative pay gap has narrowed between males and females
- there is increased access to child care
- along with smaller families
- delay in marriage
- delay in child raising and
- changes in marriage rates.

Last, but not least, the increased level of education of women has made them more competitive in the labour market. In total, these factors have significantly increased the benefits to women who enter the labour force which is directly reflected in their increasing participation rate.

These aggregate trends, however disguise the changes that have occurred between full-time and part-time employment. In particular, male part-time employment has been increasing, admittedly from a low base, only partly offsetting the significant falls in full-time participation for males. Women on the other hand have increased their participation rates for full-time and part-time work. These trends can be seen at all age levels.

There appears to be four underlying mechanisms driving the observed labour force participation patterns which we classify as:

- Gender Shifting - more female employment at the expense of male employment,
- Part-time/Casual - the growth in part-time and casual employment,
- Early Retirement - cohorts which would normally retire at pension age now retiring before hand, and
- Female re-entry - more females re-entering the work force after child bearing/raising.

In general these factors are slowly moving trends, which can be expected to continue, necessarily at a slowing rate, for many years to come. As a general proposition these trends appear to be producing a convergence of males and female labour market behaviour. In particular, unmarried women are behaving more and more like men and married women are converging, albeit very slowly, towards unmarried women.

Labour Force Status of the Aged:

The ABS *Retirement and Retirement Intentions Survey (1994)* provides some insight into employment patterns at older ages (Table 1)[1]. A significant number of people remain in employment after the pension age of 65 for males and 60 for females[2]. The participation rate for all males over 65 years of age is around 10% and around 6% for all females over 60 years of age. This phenomena of later retirement may be important in analysing the ageing society.

Table 1. Labour Force status of the aged - 45 to 90+ years old - Nov 1994.

Males	**45-49**	**50-54**	**55-59**	**60-64**	**65-69**	**70-74**	**75-79**	**80-84**	**85-89**	**90+**
Full-time	81.3%	74.6%	57.4%	34.2%	9.5%	4.2%	2.3%	1.4%	1.9%	0.0%
Part-time	5.2%	4.9%	8.7%	8.1%	7.4%	3.6%	1.5%	1.5%	0.6%	1.9%
Looking FT	5.1%	6.1%	8.4%	4.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Looking PT	0.2%	0.4%	0.5%	1.1%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%
NILF	8.2%	14.0%	24.9%	51.9%	82.8%	92.3%	96.2%	97.1%	97.4%	98.1%
ALL	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Participation Rate	91.8%	86.0%	75.1%	48.1%	17.2%	7.7%	3.8%	2.9%	2.6%	1.9%
Nonparticipation Rate	8.2%	14.0%	24.9%	51.9%	82.8%	92.3%	96.2%	97.1%	97.4%	98.1%

[1] These data have been used to calibrate the NILF profiles in RETMOD.

[2] The pension age for females is being raised progressively to 65 by 2013

Females	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85-89	90+
Full-time	38.6%	31.5%	17.3%	5.7%	1.3%	0.4%	0.4%	0.0%	0.0%	0.0%
Part-time	28.0%	27.7%	18.8%	10.7%	4.2%	1.8%	0.6%	0.4%	0.0%	0.0%
Looking FT	4.0%	2.8%	1.9%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Looking PT	1.4%	1.5%	0.7%	0.4%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%
NILF	27.9%	36.5%	61.3%	83.2%	94.4%	97.8%	99.0%	99.6%	100.0%	100.0%
ALL	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Participation Rate	72.1%	63.5%	38.7%	16.8%	5.6%	2.2%	1.0%	0.4%	0.0%	0.0%
Nonparticipation Rate	27.9%	36.5%	61.3%	83.2%	94.4%	97.8%	99.0%	99.6%	100.0%	100.0%

Further, the 1990 *Income Distribution Survey* suggests that people working for themselves in their own business retire later[3] (Table 2).

Table 2. Age-specific proportions of persons employed - 60 to 75+ years of age - Nov 1990.

		MALES				FEMALES			
		60-64	65-69	70-74	75+	60-64	65-69	70-74	75+
Wage & Salary	FT	55.0%	21.2%	5.4%	0.0%	30.4%	5.2%	8.0%	5.5%
	PT	10.0%	17.5%	24.9%	3.4%	32.5%	30.3%	23.1%	0.0%
Own Business		35.0%	61.3%	69.7%	96.6%	37.1%	64.5%	68.9%	94.5%

RIM projections show a significant increase in full-time and part-time employment at older ages as the baby boomers move through. Even with flat projections of participation rates for those 65 and over, the number of wage and salary earners at this age will double over the next 30 years. On top of this, there is a strong shift towards self employment at older ages.

AGEING AND RETIREMENT

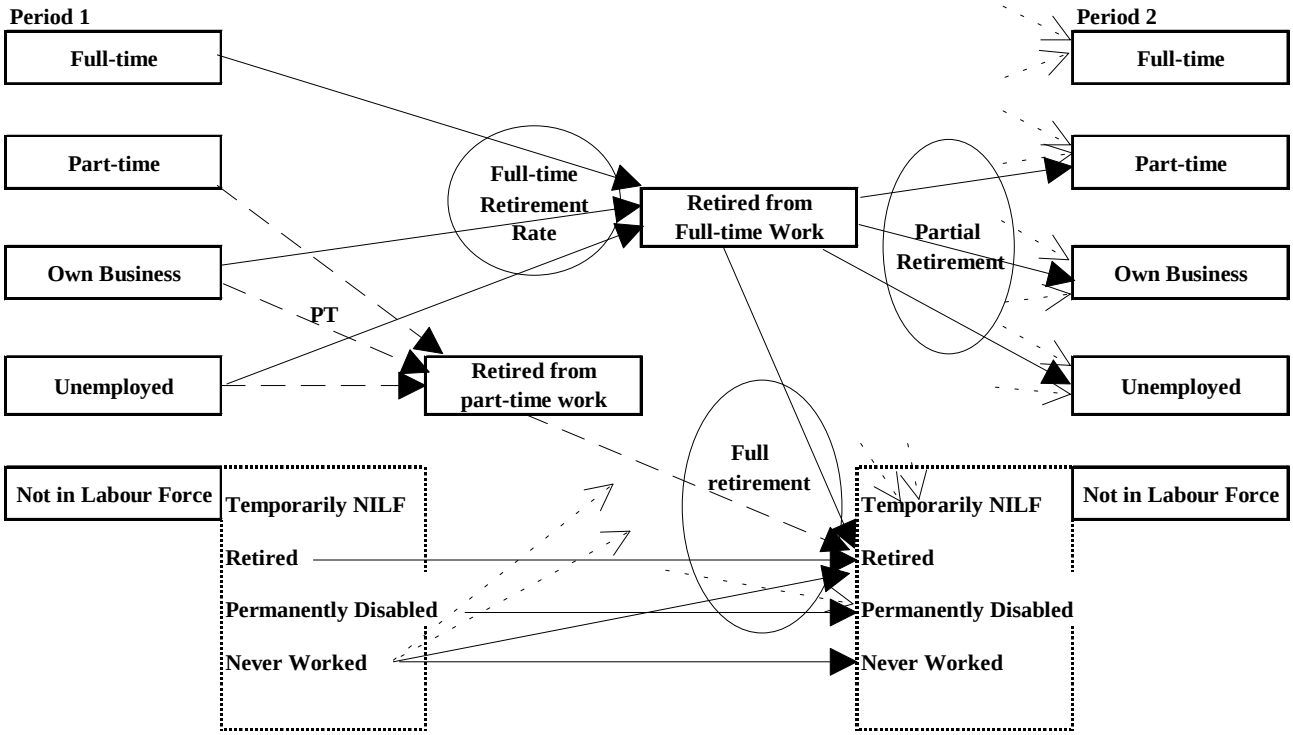
Retirement can be a complicated process to model. People may not just retire directly from work. Those in full-time work may take part-time work, become unemployed, possibly becoming a discouraged job seeker before taking the decision to leave the work force permanently (see chart 1). The question is what definition of retirement should we use and can it be measured.

Conceptually, full retirement occurs when a person leaves the work force and never re-enters it. In reality there is always the possibility that circumstances will change and a retired person will decide to go back to work. The risk of returning to the work force (re-entry risk) would appear, however, to be greater the earlier the age of retirement. We do not have any data which captures this concept, but we do have data on people who are not in the labour force and who do not **intend** to enter (re-enter) the labour force. To complicate the picture even further, there are a group of people who have never worked full-time or never worked at all. Again these people are not necessarily retired, depending on their age, there is a high probability that they will enter the work force at some time.

For many applications the concept of partial retirement may be more appropriate. There is a strong tendency to reduce the number of hours worked as people approach retirement. This is observed in

[3] Assumes little movement from wage and salary earners to own business at these later years of age.

Chart 1. Retirement Dynamics



the data as a shift from full-time to part-time work[4]. It may therefore be important to distinguish between retirement from full-time employment and retirement from part-time employment.

Persons who have stopped working full-time and do not want to work full-time again include those:
1. now working in part-time employment or unemployed looking for part-time employment
2. not in labour force who would like to work part-time at some time in the future.

Charts 2 and 3 provide a snap shot of the magnitude of the phenomena for persons late in working life. The number of males working part-time who have retired from full-time work, although a relatively small proportion, increases from around the age of 53 and stops around 73 years of age. For females, however, working part-time after full-time employment is already a significant proportion by the time they reached 45 years of age. It then decreases in importance through to about 67 years of age in line, but not as fast as, retirement from full-time work. We can expect significant changes in these profiles as the younger cohorts, with possibly different work patterns and life expectations move through.

[4] Job changes late in the working life, commonly associated with partial retirement, also involves reduced earnings. This may arise on the supply side to the extent that older workers consider a less demanding part-time job, at a lower wage, preferable to full-time work. Alternatively, the lower wage may reflect demand effects due to the loss of firm-specific human capital (Honig and Hanoch 1985).

Chart 2. Labour Force Status of Males.

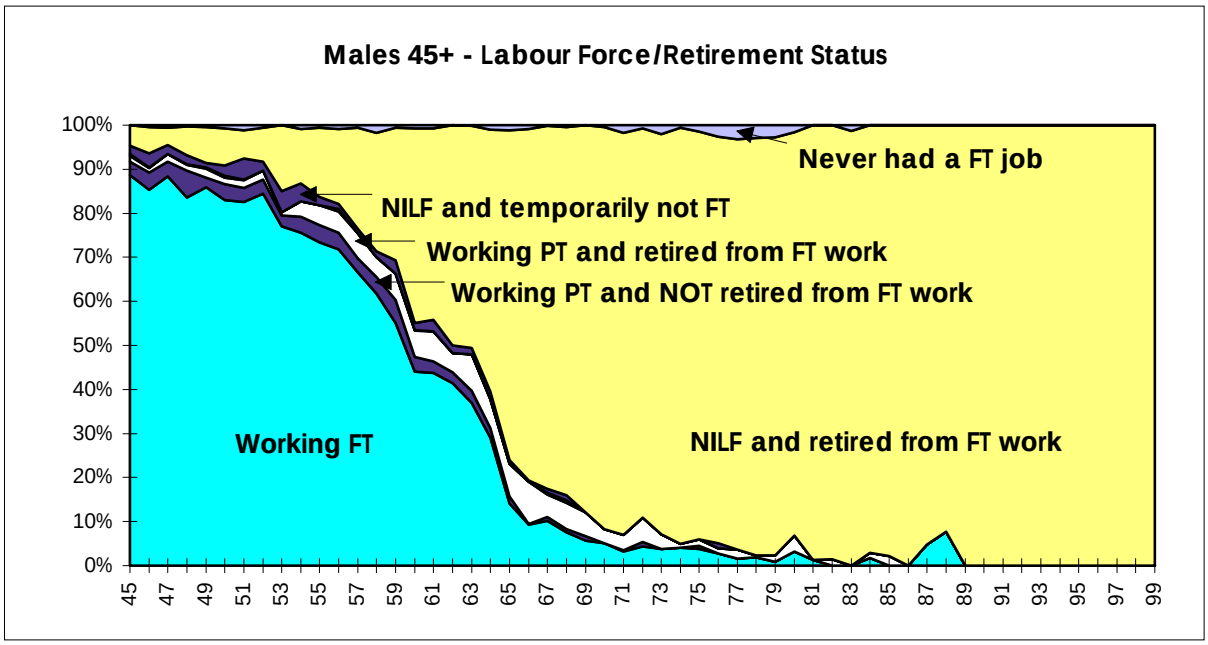
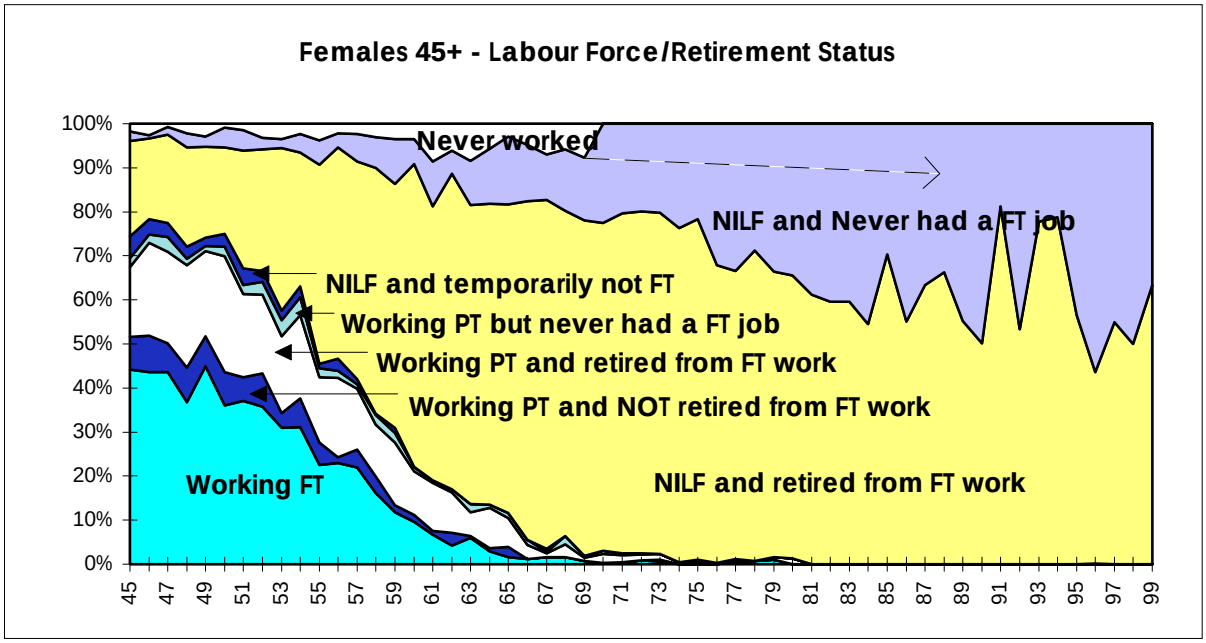


Chart 3. Labour Force Status of Females.



There have been a number of studies in the US researching the dynamics of partial retirement. A recent analysis by Ruhm (1990) found that

> "The "job-stopping" process of older workers often includes some combination of post career "bridge" employment, partial retirement, and reverse retirement. Fewer than two-fifths of household heads retire directly from career jobs, over half partially retire at some point in their working lives, and a quarter re-enter the labor force after initially retiring. In addition, post career employment is frequently located outside the industry and occupation of the career job, and there are important differences in post career labour force experiences by gender, permanent income, and career-job pension status."

Unfortunately we do not have the data in Australia to undertake a similar dynamic study.

How many people are retired?

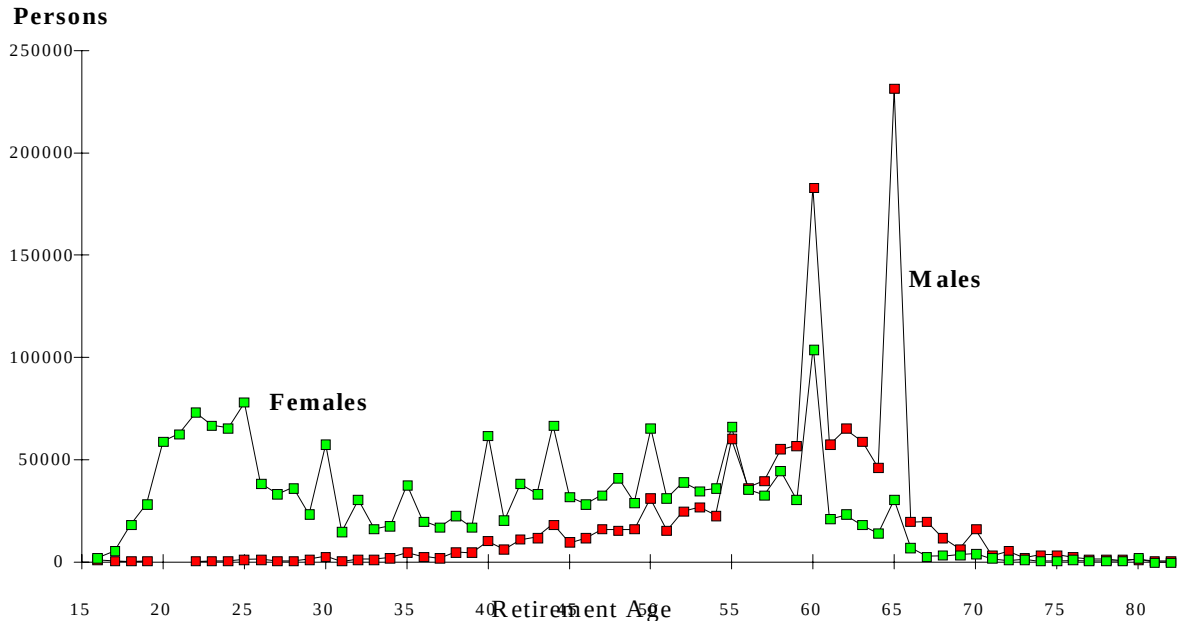
Our definition of fully retired includes all persons not in the labour force who do not intend to (or did not know if they intended to) enter the labour force and were not in an educational institution. Persons who are permanently unable to work were also included. Estimates based on these statistics will, however, be overestimated in that some retired persons will re-enter the labour force. On the other hand, the number of retired may be underestimated in that the estimate misses people who are effectively retired but misclassify themselves (particularly for persons who are unemployed and not in the survey). Finally, it has been suggested that wives (or husbands), who may be effectively retired, may not take retirement action until their spouse retires. We do not have any information on this likely phenomena

Using the ABS *Persons Not in the Labour Force (Sept 1994)* survey data in RETMOD, we estimate that some 3.2 million people (1.1 million males and 2.1 million females) were **fully retired** in 1994, out of a population of 14 million aged 15 years old and above. These estimates imply that some 17% of males are fully retired with 31% of these having retired before they were 65 years old. For women, however, 30% were fully retired with 31% having retired before 60.

Retirement Rate Profiles and Behavioural Peaks

We have used the age of retirement data from the *Retirement and Retirement Intentions Survey* to calculate age-specific retirement rates from **full-time** work (Chart 4). These are average rates for all persons in the survey and cannot be attributed to any point in time. Abstracting from the recall bunching where respondents round their age of retirement to the nearest five years, the most significant features of this chart is the behavioural peaks at 55, 60 and 65 years of age. Males have a large peak at 65 years of age, a slightly smaller one at 60 and even smaller one at 55. Females have their large peak at 60 years of age with smaller peaks at 55 and 65. These peaks are possibly generated by two mechanisms. The first is the direct link to the availability of social security

Chart 4. Age of Retirement from Full-time Work - Persons Over 45 - Nov 1994



(pension) and superannuation incomes. The second is the persistence of cultural patterns based on the historic mandatory age for retirement.

The chart also highlights other differences between males and females. Male retirement from full-time work does not occur to any degree until they pass 40. The retirement rate progressively increases until pension age of 65. Females show significant retirement from full-time work during their child bearing years. Then they appear to have a relatively constant, but significantly higher than males, retirement rate from full-time work from 30 years of age until they reach 60. Remember that this is average data for persons who are over 45 years of age. Given recent trends in female participation rates, we would expect that rate of retirement for females between 20 and 30 will have fallen for those now under 45. This is discussed more below.

The existence of behavioural peaks is also supported by data from the Australian Taxation Office on the percentage of tax filers with eligible termination payments (ETPs). Although ETPs can be obtained for reasons other than retirement, the behavioural peaks associated with retirement are clearly identified.

Retirement Model (RETMOD):

Theoretically, retirement flows can be constructed from the stock of retired by differentiation. In other words, the slope of the stocks data at any age determines the rate of retirement at that age. Single year data on the number of persons not in the labour force was combined from the ABS *Retirement and Retirement Intentions Survey (Nov 1994)*and the *Persons Not in the Labour Force Survey (Sept 1994)* to estimate the age-specific non-participation rate (charts 5 and 6).

Chart 5.

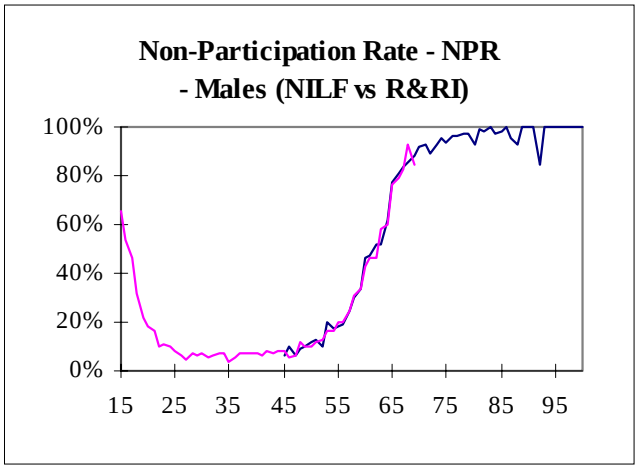
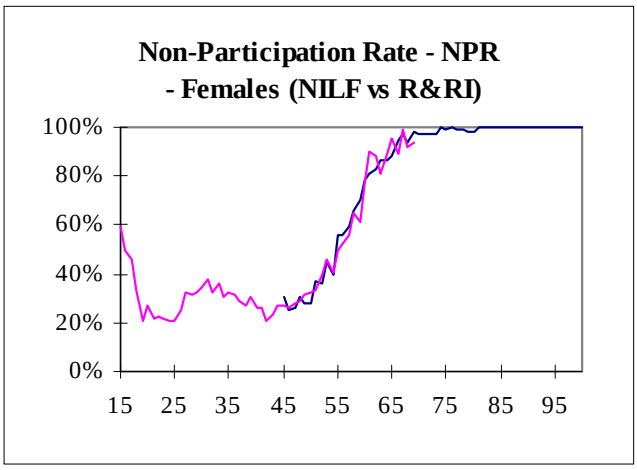


Chart 6.



Firstly we smooth[5] the nonparticipation rate (NPR) curves in four separate sections (scallops) as shown in charts 7 and 8. These scallops, which are evident in both surveys, ensure that we obtain the retirement peaks.

[5] New smoothing routines written in C have been developed to facilitate the smoothing process in RETMOD.

Chart 7. Smoothed Nonparticipation Rate (NPR) - Males

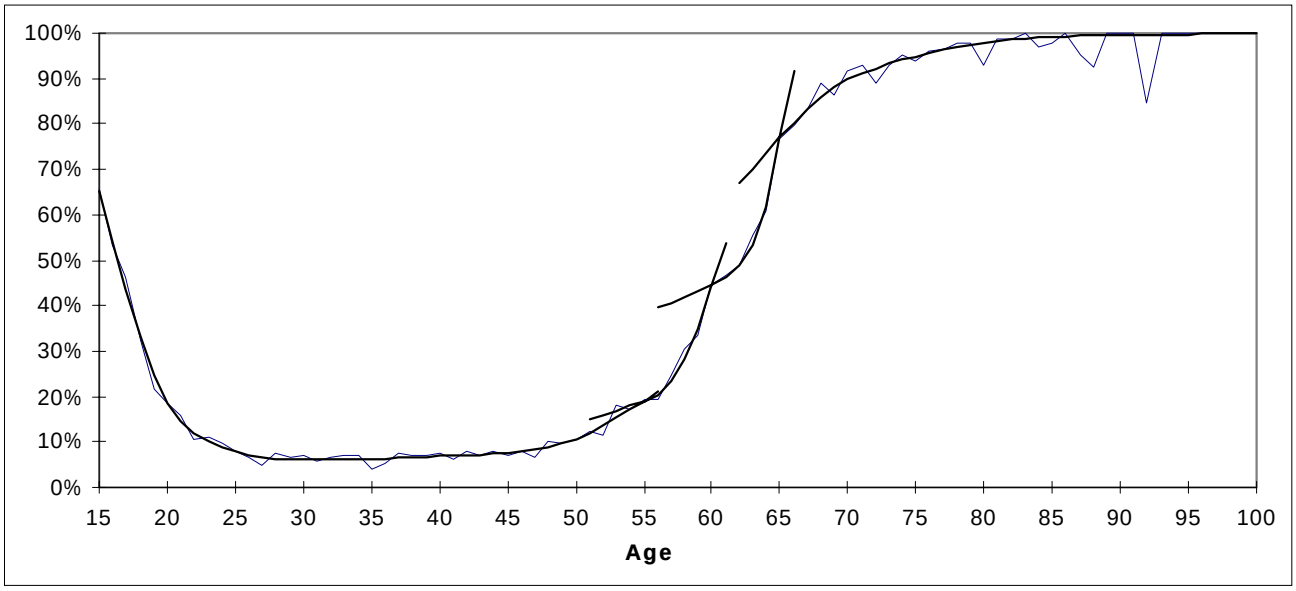


Chart 8. Smoothed Nonparticipation Rate (NPR) - Females

We then smooth the retirement share of NILF (charts 9 and 10) and combine the two to get the number of retired as a proportion of the age-specific population.

Chart 9. Retired Males as a Proportion of Not in the Labour Force

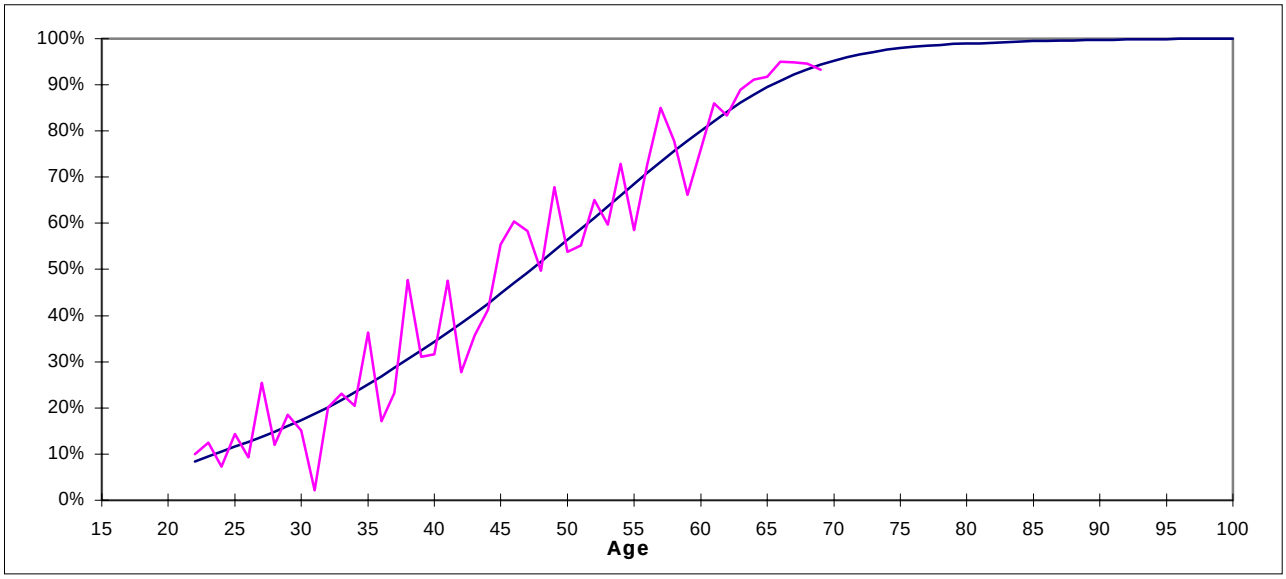
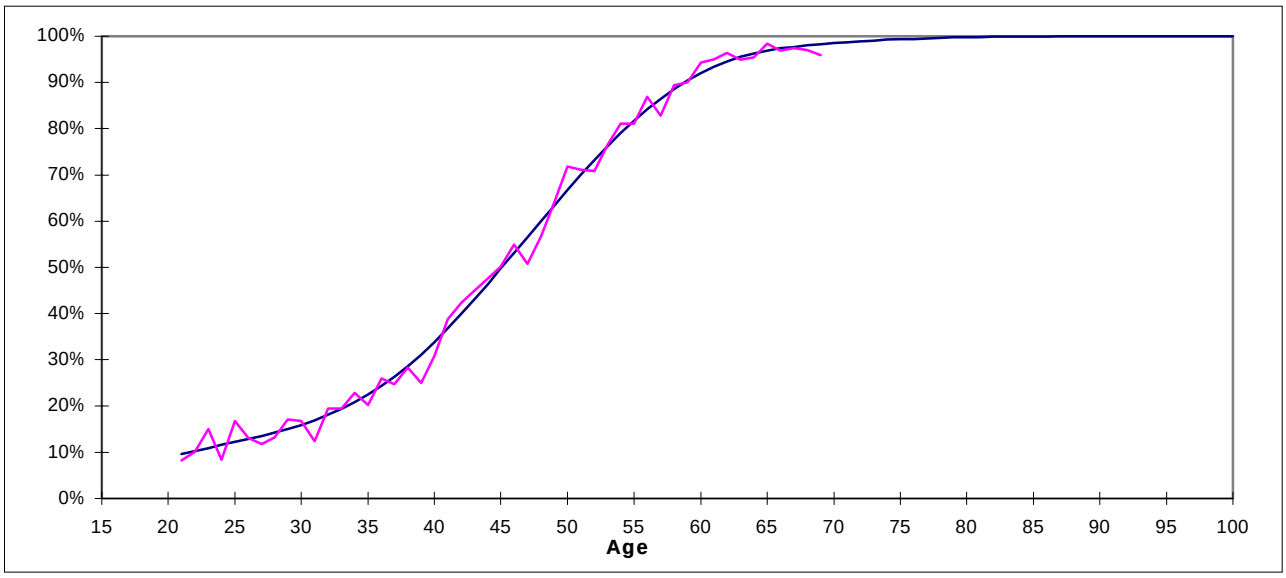
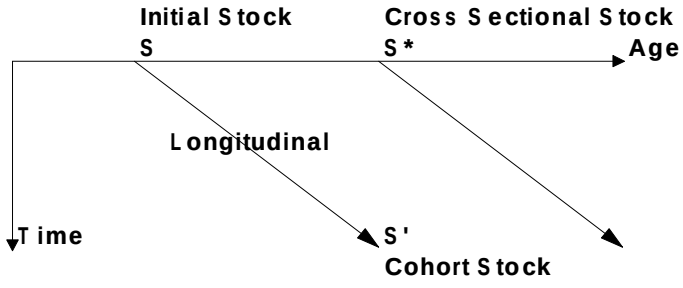


Chart 10. Retired Females as a Proportion of Not in the Labour Force



To get the correct estimates across a cohort the model must correct the cross sectional profiles to capture longitudinal effects. The relationship between the cross sectional data and the longitudinal framework is illustrated by chart 11. To convert this smoothed retired profile into flows and to

Chart 11. Longitudinal (Cohort) and Cross Sectional Stocks



capture longitudinal (cohort) estimates from cross sectional data, we use the following theoretical longitudinal framework:

If S is the initial stock then S' is the next periods stock of the cohort. Cross sectional data records S and S*, whilst time series data records S* and S'. Applying this framework to the stock of retired we have:

Next years stock of retired persons =
- Stock of retired persons last period
  - less those who died
  - less those who migrated (net)
- plus newly retired (flow).

$$S' = S + D - M + R$$

or $S' = S + E + R$ where $E = M - D$ = entry to retired stock **not** from retirement

$$S' = S\times(1+EP) + R \quad \text{where } EP = E/P = (P'-P)/P \quad \text{and } P = \text{age-specific population}$$

In terms of population rates

$$R/P = S'/P - S/P\times(1 + EP)$$

or $$R/P = S'/P'\times P'/P - S/P\times(1 + EP)$$

or $$RP = (SP' - SP)\times(1 + EP)$$ where $RP = R/P$, $SP = S/P$, $SP' = S'/P'$

We now relate this back to the cross sectional observation by using our estimates of growth in the nonparticipation rate.

$$S'/P' = S'/N'\times N'/P'$$ where N' is the number of persons not in the labour force

N'/P' is just the nonparticipation rate which is related to N*/P* by $N'/P' = \alpha N^*/P^*$
where α is the nonparticipation rate growth from LFSMOD

We assume that S'/N' is exogenously determined and its growth is given by:
$S'/N' = \beta S^*/N^*$ then

$$RP = (\alpha\beta SP^* - SP)\times(1 + EP)$$

Using this equation we obtain the retirement rate profile as shown in charts 12 and 13.

The observed retirement peaks are separated from the underlying base. These two components can be modified to analyse policy options. The peaks can be shifted and/or flattened to reflect the shift in pension age or movement away from retirement at pension age. The base can be broadened to capture early and/or later retirement.

Chart 12. Estimated Male Retirement Rates - Base and Peaks

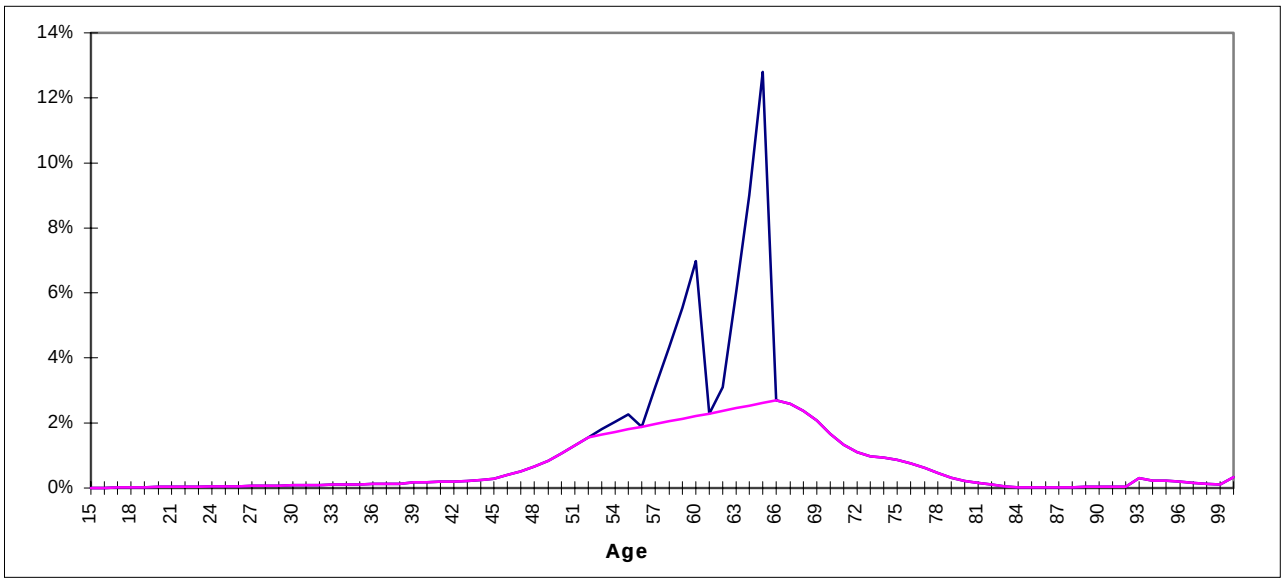
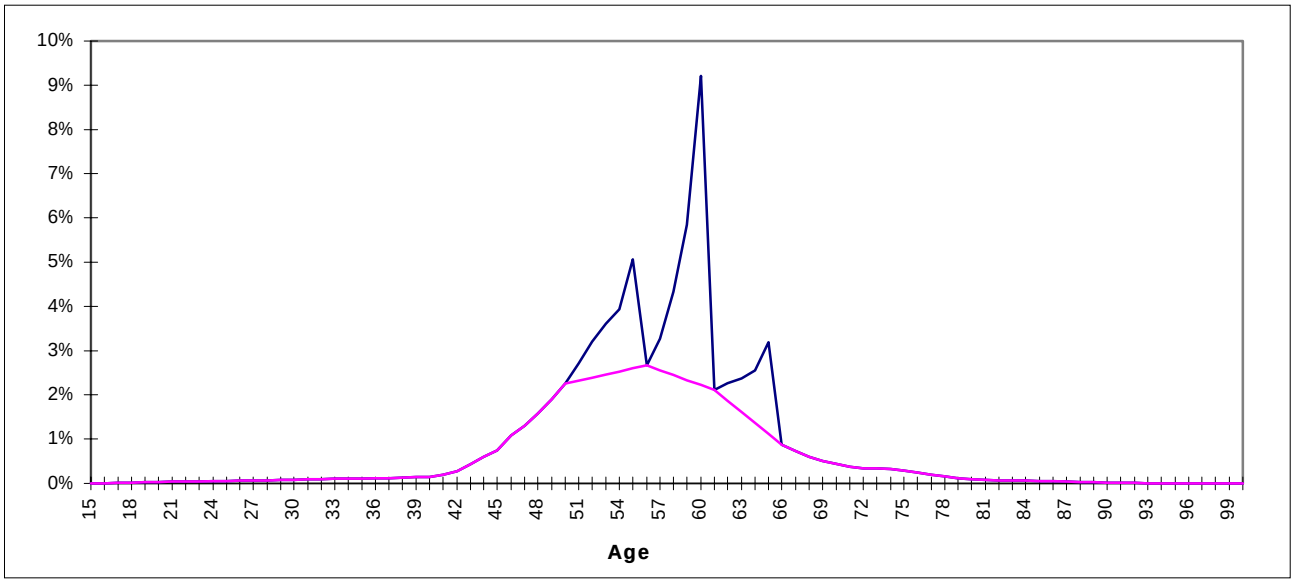


Chart 13. Estimated Female Retirement Rates - Base and Peaks



Note we are using cross-sectional data to construct longitudinal retirement profiles. To ensure aggregate consistency, the base is scaled along the cohort so that eventually everybody in a cohort is retired.

Lastly the number retiring at each age is allocated across the life-time earning deciles for input directly into RIMGROUP. Currently this is done proportionally to the number of persons who are not in the labour force in each decile. Research into differential rates has not been undertaken to date.

Retirement Dynamics

Unfortunately we do not currently have data to study the retirement dynamics for **full retirement** from the labour force. The intention to enter the labour force question was not included prior to 1994 *Persons Not in the Labour Force Survey* and was dropped from the 1995 survey.

The *Retirement and Retirement Intentions Survey* does however, provide information on the dynamics of retirement from full-time work.

Full-time work and retirement patterns of males and females are very different. Table 3 shows that while nearly all males over 45 had a full-time job in 1986, 20% of females over 45 never had. This ratio has fallen to 16% in 1994 and is expected to fall further. Table 4 shows that while only some 7% of males retire from full-time work before they are 45, nearly 60% of females had done so. That is many females had retired from full-time work at start or mid-career.

Table 3. Proportion of persons aged 45 and over who had never had a full-time job

	1983	1986	1989	1992	1994
Males	-	0.8%	0.7%	1.0%	1.0%
Females	-	20.1%	17.7%	16.2%	16.4%

Table 4. Proportion of persons aged 45 and over who had retired from full-time work before they were 45

	1983	1986	1989	1992	1994
Males	3.6%	5.2%	5.7%	7.0%	7.2%
Females	61.9%	60.2%	60.7%	59.9%	56.5%

Charts 14 and 15 show that the retirement rate for males at age 65 and females at age 60 (the pension ages) has fallen significantly. Similar charts are available for the other retirement peaks. The 60 year old retirement rate peak for males rises around 1984 then falls away after that. This may reflect the interaction of the move to earlier retirement for 65 years of age being initially greater than the move to early retirement from males aged 60. Both males and females show the 55 year old retirement peaks increasing.

The underlying calculations assume that the death rate is similar between persons in the labour force and persons not in the labour force. Kestenbaum (1985) suggests that this is not the case for the United States. He estimates that the probability of death can be at least two times higher for persons not in the labour force. Applying a correction of this magnitude to our estimates would make the fall in pension age retirement rates even larger.

Chart 14. Males - 65 Years of Age
Retirement Rate at Pension Age

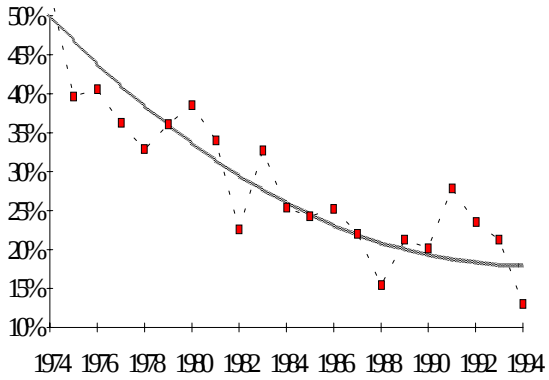
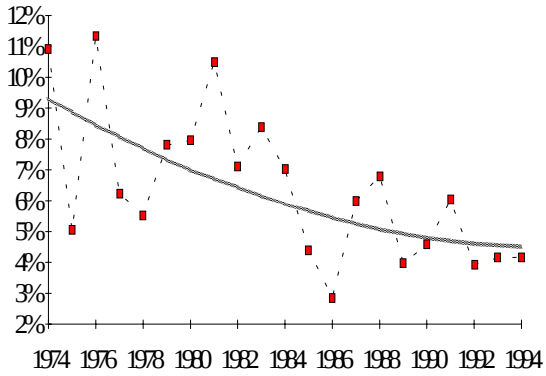


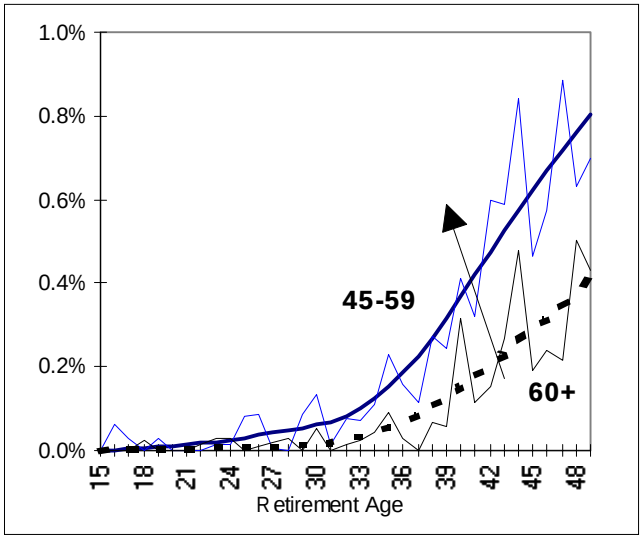
Chart 15. Females - 60 Years of Age

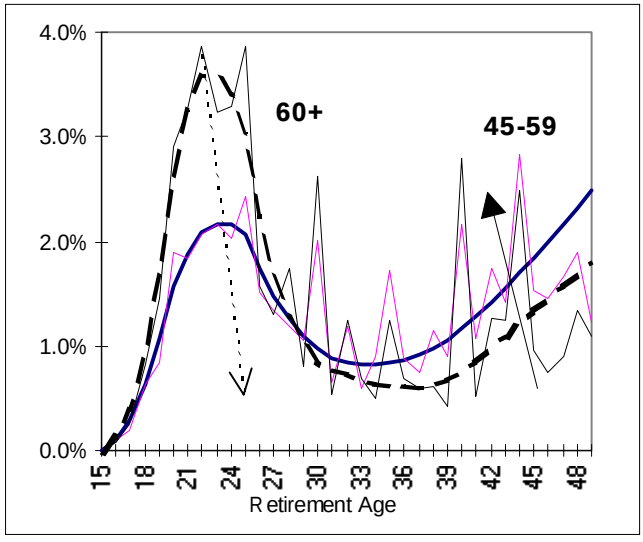


Using matrices of age retired from full-time work by current age from the five surveys of *Retirement and Retirement Intentions*, permits the estimation of age-specific retirement rates. Chart 16 shows that since 1960, early retirement rates from full-time work, for both males and females, have quadrupled for persons aged 45 to 59.

Chart 4, as already discussed, displays the average retirement rate from full-time work for persons over 45. These data can be decomposed into different cohorts. Charts 16 and 17 graph the data for two broad cohorts: persons aged 45 to 59 and persons 60 years and over. These charts dramatically illustrate the changes that have occurred between older and younger cohorts (as indicated by the arrows). We expect that these trends will continue for persons under 45 years of age.

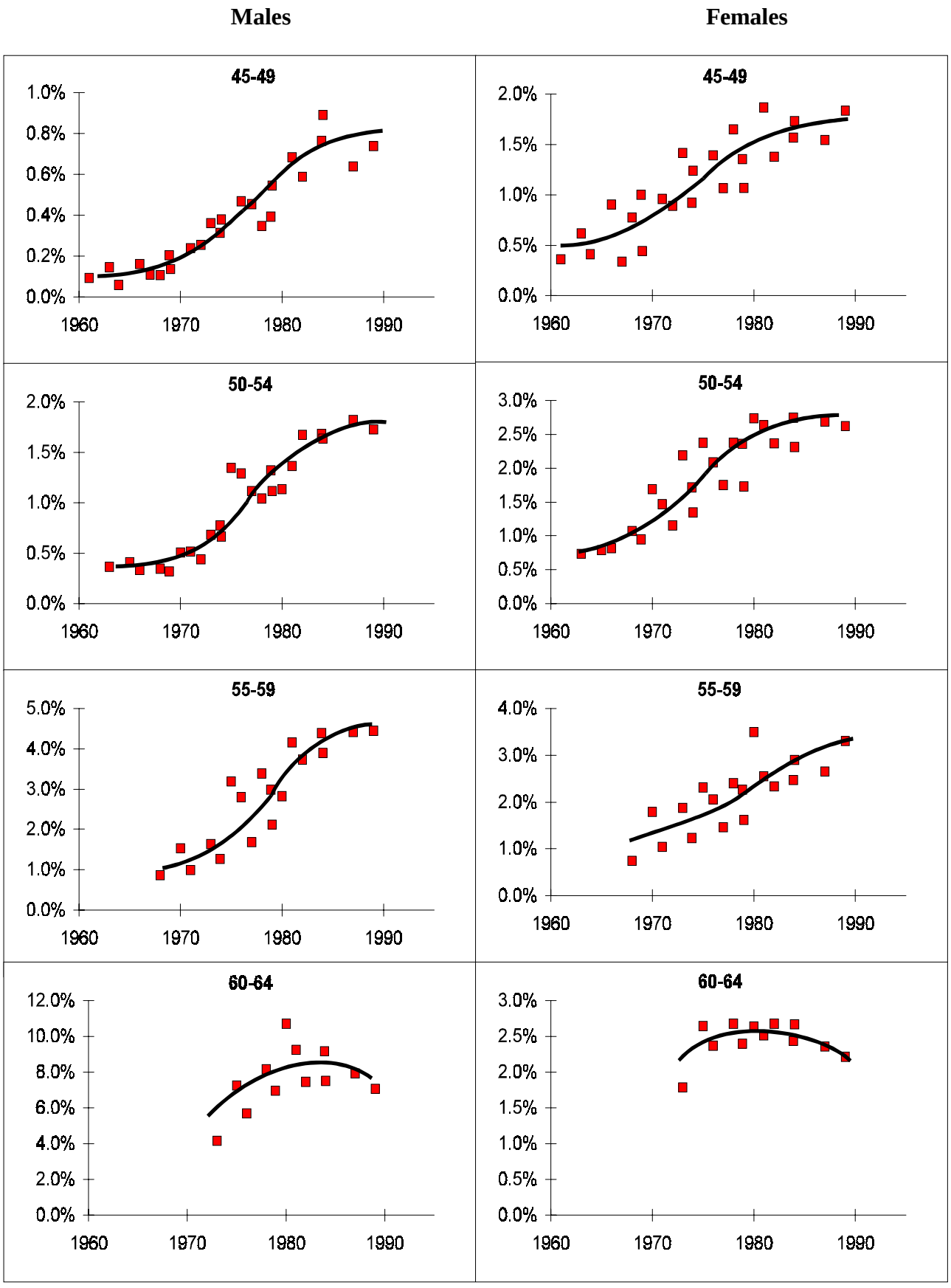
Chart 16. Males **Chart 17. Females**
Retirement Rates from Full-time work for different cohorts - 45-59 and 60+





All in all, these charts clearly show that early retirement is a real phenomena for both males and females. The results suggest, however, that the increases in early retirement may have slowed somewhat and might even be stabilising. New data from next *Retirement and Retirement Intentions* survey should throw further light on this issue.

Chart 18. **Average Age-specific Retirement Rates from Full-time Work**
(percentage of single year age-specific population)



Participation Rates are Not Indicators of Retirement:

Most analysis of retirement, both in Australia and overseas, treat the changes in participation rate as a measure of early retirement (see bibliography). These studies have used the fall in age-specific participation rate as an indicator of the shift towards early retirement. This methodology is highly suspect and in some circumstances totally misleading. Firstly, being classified as not in the labour force does not mean retired. Our estimates indicate that the retired only make up some 60% of those classified as Not in the Labour Force. Secondly, but more importantly, the movements in participation rates and retirement rates can be in the opposite directions. This is particularly true for females. In general, age-specific participation rates for females are rising, but at the same time as age-specific retirement rates are also rising.

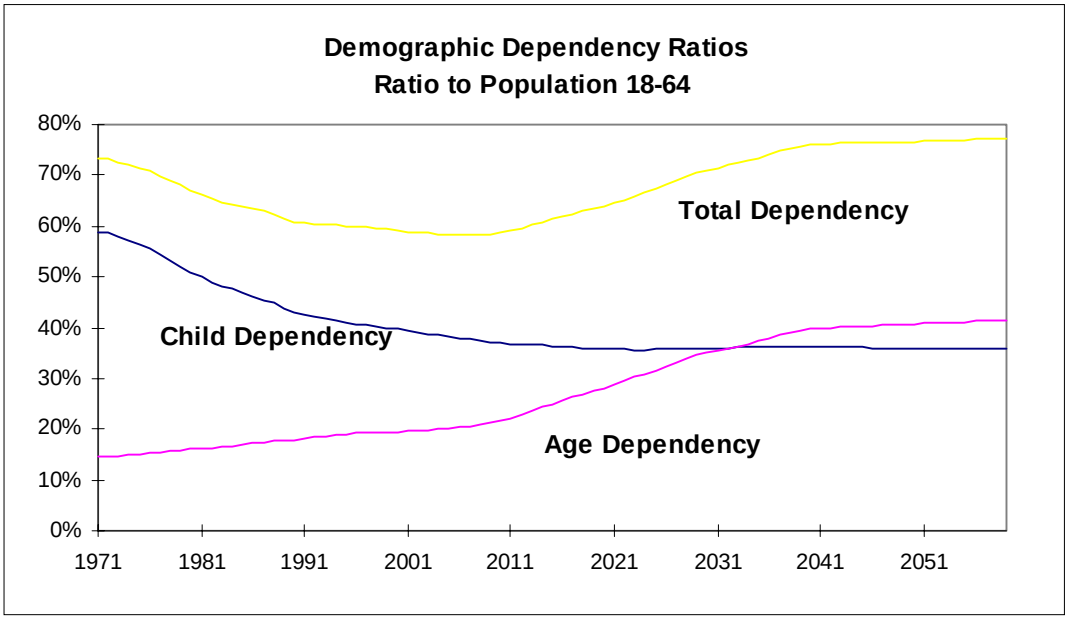
This phenomena is easily explained when one considers what is happening to the four mechanisms driving labour force participation rates (introduced above). For women the retirement dynamics are swamped by gender shifting and the changes in re-entry to the work force after child bearing/raising. The bottom line is don't use participation rates as an indicator of retirement.

DEPENDENCY RATIOS

Chart 19 shows the age, child and total dependency ratios for the population 18-64. The age dependency has been calculated as the ratio of the population aged 65 and over to that age 18-64 years.

The aged dependency ratio is predicted to rise from 14% in 1971 to 41% by 2059. Concurrently child dependency is predicted to fall from 59% in 1971 to 36% in 2059. These measures of dependency assume that the dependency burden is carries by all those aged 18 to 65 years. They do

Chart 19. Projected Demographic Dependency Ratios



recognise that many in the working age group are also dependent, nor do they capture the changes that are occurring in the labour force in this age group.

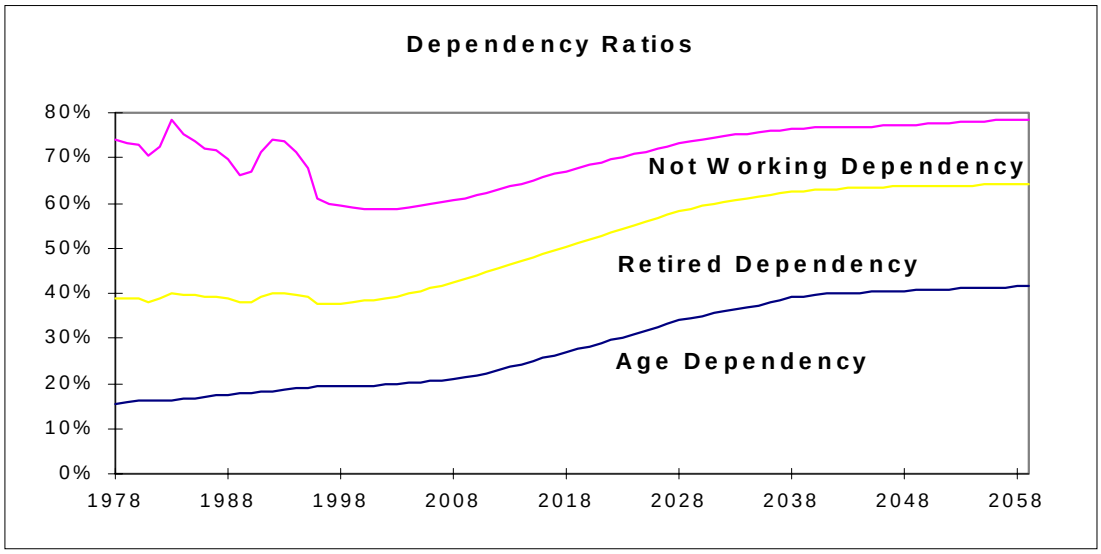
Two alternate dependency ratio are the "not working" dependency ratio and the retired dependency ratio (chart 20). The not working dependency ratio is simple the ratio of persons not working to

those who are. This ratio goes too far the other way. It includes many people in the not working category who are not dependent. Further, cyclical changes show up in both the denominator and the numerator producing wild swings in the measure.

The retired dependency ratio is the ratio of those retired to those working. If retirement is considered to be the point in a persons lifecycle were many shift to greater reliance on public support, then the retirement dependency measure might be an appropriate indicator. This indicator can be used to assesses the burden that future workers will face in supporting the growing number of retired.

RIM estimates that the this ratio is currently around 40% and is projected to rise to over 60% next century. It is this concept which underlies the costing analyses that the RIM Task Force undertakes using RIMGROUP.

Chart 20. Comparison of Dependency Ratios



Conclusion:

This paper has presented a wide ranging overview of RIM's modelling capability and its analysis of the ageing society. In particular it details our modelling of working life and retirement behaviour and the processes we believe are shaping our future.

The paper notes that there are various ways to measure the burden imposed by the ageing society via a range of measures of dependency. It argues that the usual measure of age dependency used to analyse the ageing problem should be replaced by a broader measure of retired dependency. Using this measure, analysis can be performed to properly assess the burden that future workers will face in supporting the growing number of retired.

Lastly, the paper illustrates two innovative techniques used to model retirement behaviour:

- non-parametric smoothing with discontinuities, and the
- transformation of cross-sectional stock data into longitudinal flow profiles.

I believe that these and associated techniques may have wider application in demographic research.

Attachment A

SUPERANNUATION MODELS

INDMOD - Individual Model
INMOD is a lifecycle projection model of superannuation and retirement incomes for hypothetical individuals and couples written in EXCEL.

RIMHYPO - Retirement Income Modelling Hypothetical Model
RIMHYPO - which is a very detailed lifecycle projection model of working life incomes, superannuation, other savings and retirement incomes for hypothetical individuals and couples written in SAS.

RIP - Retirement Income Policy Model
RIP is the Task Force's enhanced version of the National Mutual Retirement Income Policy Model which tracks the aggregate superannuation accumulations and retirement incomes of age gender cohorts and which gives estimates of the national saving and fiscal impact of superannuation policies.

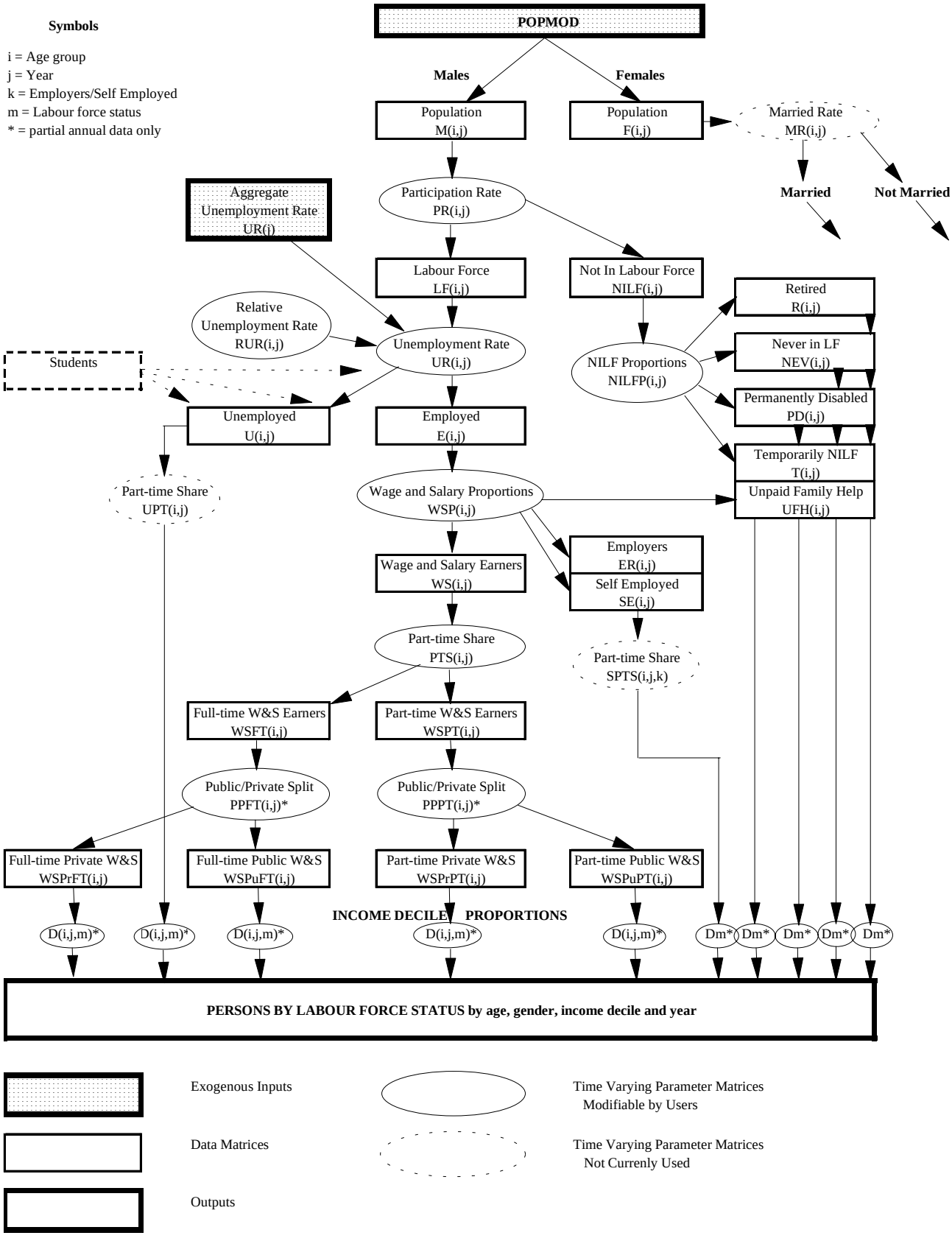
MEMSUPER - Member Superannuation Model
MEMSUPER is a static microsimulation model of employee personal superannuation based on a highly disaggregated summary file from the ABS Superannuation survey 1993.

SEMSUPER - Self Employed Member Superannuation Model
SEMSUPER is a static microsimulation model of self employed personal superannuation based on a highly disaggregated summary file from the 1992/93 individual taxation returns.

RIMGROUP - Retirement Income Modelling Group Superannuation Model
RIMGROUP is a new aggregate projection model. RIMGROUP projects the superannuation, other savings and retirement incomes of age, gender, career income decile groups of the population by tracking mortality, labour force status, sector of employment, income and type of superannuation fund across every year of a group's working life. Calculations are done at the average for the group and accumulated assets are pooled. The approach is hence at a level of aggregation above unit records but below age-gender cohorts. The model gives projections on both the 'quantum and distribution' of taxation, saving, social security payments and tax concessions.

Attachment B

Labour Force Status Model - LFSMOD



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problem should be replaced by a broader measure of retired dependency. Using this measure the paper assesses the burden that future workers will face in supporting the growing number of retired. The aged dependency ratio does not, however, provide a good measure of the relative burden shared by those who are actually working. A better measure might be the retired dependency ratio defined as the ratio of persons retired to those actively in the labour force. Our analysis shows that this ratio i*****[The paper argues that the usual measure of age dependency used to analyse the ageing s currently around 40% and is projected to rise to over 60% next century.]

*****[This paper discusses the development of our retirement model RETMOD. In doing so, it provides an overview of the conceptual and measurement issues surrounding retirement and details the modelling of retirement rate (flows) profiles of cohorts, from cross sectional retirement stocks.]

This is The aged dependency ratio is predicted to rise from 13% in 1972 to 39% by 2059.

In this paper I outline the work of the RIM Task Force, raising along the way some problems and methodological issues we have faced.
In particular I will raise by way of illustration issues of:

- Combining data from many sources (different levels of aggregation)
- Working with group data
- Estimating smooth univariant and bivariate profiles
- Developing longitudinal profiles from cross-sectional data